

THE CONTRIBUTIONS OF AGRICULTURAL COOPERATIVES TO PROMOTE SUSTAINABLE FARMING IN PREY KABBAS DISTRICT, CAMBODIA

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ABSTRACT

One of Cambodia's major agricultural problems is the improper and excessive use of agrochemicals. Its heavy use has contributed to degradation of soil and water supplies and significantly damaged ecosystems. The World Bank recommended that Cambodia strengthen sustainability for future agricultural growth. This study sought to determine the contributions of agricultural cooperatives to promote sustainable rice farming and the development challenges of agricultural cooperatives. This study was based on the survey conducted in Prey Kabbas District, Takeo province in July 2019. A mixed methodology was employed, and the three agricultural cooperatives that supported sustainable farming were selected. A total of 140 farmers were randomly selected and interviewed using a semi-structured interview-based survey. Most of the selected agricultural cooperatives adopted sustainable rice farming by using highly resistant varieties and utilized at least fifty percent of natural materials in the field. Three factors provided by agricultural cooperatives, included financial support, social capital, and technical support, facilitated the practice of sustainable farming. However, some significant challenges hindered the operation of agricultural cooperatives. All key stakeholders must strengthen agricultural cooperatives to improve rural livelihood and promote sustainable agriculture for future agricultural growth.

Key words: financial support, members and non-members, social capital, sustainable agriculture, technical support

INTRODUCTION

Cambodia has experienced rapid growth of the agriculture sector and, accordingly, a profound transformation of the rural society, from traditional subsistence to commercial agriculture. While intensification occurs in some regions with a recent boost in fertilizer use and a slow but steady rise in food production, their production system depends on outdated technologies coupled with a lack of capital, market information, infrastructure, and high production cost. Most Cambodian farmers use agriculture to meet their daily consumption needs and cultivate almost exclusively rice using traditional farming practices (Diepart 2010; Srean et al. 2018). Small and variable (depending on seasonal weather conditions) productions make farmers extremely vulnerable economically (Ministry of Planning 2013). Besides, Cambodia is also considered one of the countries in Southeast Asia that is affected positively by climate change. From the enormous floods in 2011 to the prolonged droughts in 2019, Cambodian farmers have been increasingly exposed to the adverse effects of climate-related risks, both in crop growth and pest and disease outbreak.

Increased awareness of the negative environmental and farming impacts of conventional farming led to a drive for more sustainable farming systems. Several scientific studies on sustainable farming techniques such as Integrated Pest Management (IPM), Farmer Field Schools (FFS), and, more recently, low-input farming systems such as the Rice Intensification System (SRI) are ongoing in Cambodia (Beban 2008). Organic farming has expanded across Cambodia since the late 1990s, and now there are many organizations supporting organics, including non-governmental organizations (NGOs), international donation agencies, private businesses, and government offices. The Royal Government of Cambodia has also established organic farming as a priority sector (UNESCAP 2002), to achieve food stability, diversify rural livelihoods, and gain access to value-added markets. It is essential to strengthen sustainable farming to ensure Cambodian agriculture's future growth (World Bank 2015).

Even though the sustainable farming system, such as organic farming, has the potential for targeting niche markets and creating high farming incomes, it is reported that few Cambodian farm households choose to practice this system. One way to develop sustainable farming is to promote agricultural cooperatives (ACs), facilitating members financially and socially. This study sought to identify contributions of agricultural cooperatives to promote sustainable agriculture and its challenges, based on interviews with ACs members. Differences in costs and returns of rice farming, and other outcomes such as the differences in financial support, natural farm inputs, technological support, and social capital between ACs members and non-members were examined.

MATERIALS AND METHODS

This study was conducted in Prey Kabbas District, Takeo province, one of the most significant rice-producing areas in Cambodia, and 83% of the population are engaged in the agricultural sector. Consequently, this area is regarded as low diversification in farming systems, and is prone to natural disasters such as drought and flood every year. With such poor farming conditions, farmers are encouraged to utilize agricultural methods that are more resistant to floods and reduce agrochemical use to mitigate the environmental crisis.

This study employed both primary and secondary data. Three agricultural cooperatives that promoted sustainable farming in the study area were selected: Reaksmey Rong Reung Agricultural Cooperative (RR AC), Chomnoum Chomreun Phal Agricultural Cooperative (CC AC), and Sdok Sdom Agricultural Cooperative (SS AC). A total of 140 farmers including 30 ACs members from each agricultural cooperative, and 50 non-members were randomly selected and interviewed using a semi-structured interview. Qualitative data were also derived from ACs, department of agricultural, fisheries, and forestry offices in Prey Kabas District and Takeo province, online journals, reports, and other sources.

The collected data was mainly analyzed using descriptive analysis. However, considering the vast differences in the economic performances of rice production among ACs members and non-members, gross revenue, gross margin, and net profit were analyzed to determine the economic returns. The gross revenue was determined by multiplying the yield of paddy with the price of paddy. The gross margin was determined by deducting the costs of intermediate inputs and hired labor from the gross revenue. Lastly, the net profit was determined by subtracting family labor costs, the cost of owned land, and depreciation cost from the gross margin. Additionally, a T-test analysis of two samples was used in this research, assuming unequal variances.

RESULTS AND DISCUSSION

Structure of agricultural cooperatives in the research area. Under the current Royal Government policy, all three agricultural cooperatives have genuinely embraced the sustainable farming movement and have started their businesses with the same initial services that provided ACs members with credit,

resistant variety seeds, and natural fertilizers. New emerging businesses were observed in the CC AC and SS AC. CC AC offered additional marketing to its members by buying crops from them and selling to middlemen or exporting to neighboring countries, such as Vietnam (Table 1). Simultaneously, SS AC also provided additional services to its members by purchasing paddy, offered drying and milling facilities, produced organic rice wine and animal feeds, and sold their organic goods to five stores in Phnom Penh. These existing and new businesses have benefited ACs members in many ways, incredibly motivating them to utilize more natural-based agricultural inputs than agrochemical products.

Table 1. General profile of agricultural cooperatives in the research area

	RR AC	CC AC	SS AC
Establishment years (years)	2014	2013	2013
Initial members (members)	131	12	61
Current members (members)	145	70	265
Current capital (USD)	12,500	36,000	650,000
Initial members fee (USD)	0	0	0
Share (USD/share)	25	25	25
Businesses	Credit and input supply	Credit, input supply, and marketing	Credit, input supply, marketing, drying paddy and milled rice service, and processing.

Socio-economic characteristics of ACs members and non-members. The primary characteristics of the interviewed farmers are presented in Table 2. The age and farming backgrounds of ACs members and non-members were not substantially different. There is no significant difference between members and non-members in terms of planted land; however, it is reported that members of ACs have marginally more substantial family members than non-members. Having extended family members but small planted land would likely low in hired labor costs in farm operations. Besides, ACs members were likely to obtain higher education and owned more cattle than non-members. This suggested that it is easier for ACs members to adopt sustainable farming than non-members. Overall, the socio-economic characteristics between ACs members and non-members shared quite a similar background. Therefore, the changes in their agricultural output and income enhancement could be attributed to the agricultural cooperative memberships.

Table 2. Socio-economic characteristics of ACs members and non-members

	ACs members	Non-members	T-test (t stat)
Number of households (HH)	90	50	
Average family size (person)	4.63	3.89	2.90 *
Average age (years)	51.24	49.89	0.48
Years of education (years)	7.87	6.58	2.11 *
Years of farming experience (years)	31.13	28.42	0.97
Average area planted per HH (ha)	1.01	1.05	-0.12
Average number of cattle owned (heads)	1.3	0.64	2.42 *
Average off-farm income (USD/month)	113.75	71.15	1.15

*p<0.5

Note: Given the similarities of features between members of three ACs, all members are grouped into one, ACs members

Contributions of agricultural cooperatives to promote sustainable farming to members. Three key factors that agricultural cooperatives used to promote sustainable farming were financial support, technical support, and social support. The distribution of opinions and benefits obtained from the respondents is explained mainly in the descriptive analysis.

Financial support. Lack of capital has been a significant challenge for farm households in the study area (Bunthan and Yamada 2019). Two main financial advantages given to members from the agricultural cooperatives were observed.

1. Advantage to credit. It was observed that members of ACs have better access to credit than non-members (Table 3). Credit service in agricultural cooperatives offered loans for members who wish to purchase natural farm inputs from the cooperatives with no interest-rate. ACs members might also have access to loans with low-interest rates and no collateral required for other agricultural purposes, given that the majority of Cambodian farmers live on land without the official title. However, the number of loans that farmers could take was still minimal following each agricultural cooperatives' policy (less than 250 USD). Although access to loan services from agricultural cooperatives is illegal for non-members, some are still able to get this service. Due to high-interest rates, no official land title, and uncertainly about farm output and price, non-members had difficulty accessing loans and payback. Although access to input supply stores did not require any collaterals, however, there was no timely payment, so non-members needed to sell their products at low prices as soon as they harvest to pay back in time. Theoretical and conventional reasoning, it is said that higher access to credit will result in higher agricultural output (Francis et al. 2019; Sothorn 2020).

Table 3. Percentage of ACs members and non-members accessed to credit

Type of Credit	ACs Members (n=90)	Non-members (n=50)
Formal*	90 (100%)	23 (46%)
• Banks	2 (2%)	2 (4%)
• MFIs	8 (9%)	9 (18%)
• Cooperatives	80 (89%)	12 (24%)
Informal	0	27 (54%)
• Relatives/Neighbors	0	2 (4%)
• Input supply stores	0	25 (50%)

Note: * The loan interest rate of banks and microfinance institutions is around 1.5% - 1.8% monthly, while agricultural cooperatives are from 1% - 1.3% monthly.

2. Advantage to natural farm inputs. High cost and unavailable natural farm inputs have been identified as the significant constraints in adopting sustainable farming in the study area (Bunthan and Yamada 2019). To promote this practice, ACs have provided resistant variety seeds, natural fertilizer, and natural bio-liquid fertilizer to members at a lower price than the chemical ones under the Boosting Food Production Program of the Royal Government of Cambodia. ACs members spend less on chemical fertilizer than non-members (Table 4). However, it is noted that the overall cost of fertilizers of ACs members was higher than non-members. This was because of the higher cost of animal manure that ACs members purchased from other villagers to apply in their rice fields and combine with processed natural fertilizers bought from ACs.

Besides, ACs also have supported members to produce aromatic rice varieties with high resistance to pests and floods to cut down on agrochemical products' unnecessary application. 0.25 USD

per kg is given to seed producers, and an agreement between seed producers and agricultural cooperatives is set to sell seed with a quality guarantee at 0.40 USD per kg. Seeds usually cost 0.65 USD per kg; with this program, it is sold to ACs members; only 0.45 USD per kg. Within 0.45 USD per kg, 0.05 USD per kg of profit goes to ACs. Furthermore, ACs in the study area collaborated with other private fertilizer companies to stock up the natural fertilizers for their members without additional transaction costs.

The paid material cost of non-members was significantly higher than ACs members (Table 4). Paid material costs were the ones that directly affected the farmers' financial condition. The high material cost could disrupt farm production activities and put farmers in debt. This suggested that agricultural cooperatives had played a massive role in encouraging farmers to pursue a sustainable farming system and minimize their farm operation costs while conserving the environment.

Table 4. Costs of farm inputs between ACs members and non-members

Variables	Members		Non-members		T-test (T-stat)
	Mean	SD	Mean	SD	
Number of households (HH)	90		50		
Commercial seeds (USD/ha)	4.22	13.17	11.83	25.38	1.62
Imputed cost of seed storage ⁽¹⁾ (USD/ha)	36.02	21.48	70.13	46.77	-4.06 *
Chemical fertilizer (USD/ha)	32.02	36.06	53.19	26.38	-2.77 *
Organic fertilizer (USD/ha)	40.33	54.49	8.41	35.15	2.86 *
Imputed cost of organic fertilizer ⁽¹⁾ (USD/ha)	15.08	22.99	10.74	15.97	0.90
Pesticides (USD/ha)	7.68	11.83	18.12	19.38	-2.79 *
Herbicides (USD/ha)	10.50	11.84	21.97	12.57	-3.95 *
Diesel (USD/ha)	24.54	17.80	21.31	17.91	0.76
Water charge (USD/ha)	2.93	12.19	4.81	16.87	-0.54
Paid material cost ⁽²⁾ (USD/ha)	121.59	46.84	139.79	68.34	-1.33 **
Total material cost ⁽³⁾ (USD/ha)	173.30	39.68	220.51	66.29	-3.77 *

*p<.05, **p<.01

Note: ⁽¹⁾ Imputed cost is the opportunity cost to farmers of using resources owned by themselves to produce its output.

⁽²⁾ Paid material cost is calculated by summing up all cash expenses of agricultural inputs.

⁽³⁾ Total material cost is obtained by adding up all the cost of agricultural inputs both cash and non-cash expenses.

Technical support. Training and demonstrations from ACs board members played an essential role in educating and spreading sustainable farming techniques to members. The percentage of training participation between ACs members and non-members was significantly different (Table 5).

Educating members with practical information is always the main goal of target agricultural cooperatives, which would explain why ACs members have more opportunities to join training more frequently than non-members. ACs members are found to understand better soil management, pests, weeds, diseases management, livestock management, and the harmfulness of using the chemical products than non-members. They are seen to use more natural fertilizers (animal manure, liquid fertilizer, and compost) in their farm operation. In terms of pest control, ACs members did not apply

much insecticides as they chose seed varieties with high resistance to pests. Besides, some pest management techniques were observed among ACs members by mixing cooking oil with detergent to spray on the pests directly, and some tended to plant herbs around their field to repel insect pests. Non-members, on the other hand, depended almost solely on insecticide applications.

Table 5. The training that ACs members and non-members have attended

Training Subject	Detailed Contents	ACs Members (%)	Non ACs members (%)	P value (Fisher's exact test)
Soil management	1. Conservation tillage	43	0	4.2E-03*
	2. Mulches, cover crops			
	3. Compost making	60	32	2.5E-03*
Pest, weed, and disease management	1. Selection of high resistance plant variety seeds	63	30	2E-04*
	2. IPM			
	3. Intercropping			
	4. Crop rotation			
Livestock management	1. Livestock management	23	6	0.02*
	2. Animal vaccination, feeds and cage or pen			
Safe use of agrochemicals	1. Hazardous agrochemicals	76	15	1E-04*
	2. Proper use of agrochemicals			

Social capital. The relationships provided by the ACs in the study area have helped ACs members receive better benefits from various key stakeholders and supported them to adopt sustainable farming. Almost all ACs members have attested that without being part of the ACs, they could not have begun practicing sustainable agriculture, nor could they receive such benefits. Two kinds of relationships were found within ACs: direct relationship and indirect relationship.

ACs board members work closely with local authorities to build their ACs members' capacity and strengthen their organizations. Both officers and ACs board members always cooperate to bring new programs, subsidies, and training from both public and private agencies to ACs members. This good relationship with local authorities would improve their food security, knowledge development, and financial support in the study area. Non-members, on the other hand, did not have many opportunities to engage closely with the local authority. They tended to work as individuals and seek information through their friends and neighbors who have been undergone training before.

The indirect relationship between ACs farmers and agricultural retailers also existed. The source of the market is critical to farmers, especially to organic rice farmers. Marketing officers of ACs directly transported their natural goods to the contract stores monthly. They always report information gathered to their members, such as consumers' preferences, feedback, and market price, in every monthly meeting. Besides sharing updated information, members are asked to update their farming performances, share their concerns, and help each other strategize their future farming plan. Although ACs members share the same information monthly, only those who produce organically can receive better price negotiation and avoid the fluctuating price by local middlemen.

These direct and indirect relationships helped ACs members build better social capital, obtain more accurate information, and better negotiate with market price than non-members. At the same time, these also helped promote sustainable farming by providing additional marketing sources to members.

Disparities in costs and returns. Disparities in costs and returns between ACs members and non-members are usually observed in rice farming, as it is mainly produced in the study area (Table 6). In terms of the economic returns, this study examined indicators such as gross revenue, gross margin, and net profit of each group's rice farming.

Table 6. Costs and returns of rice farming categorized by ACs members and non-members.

Variables	ACs Members		Non-members		T-test (T-stat)	
	Mean	SD	Mean	SD		
Number of HH (HH)	90		50			
Paddy yield (ton/ha)	3.73	0.84	3.58	1.04	0.63	
Paddy price (USD/ton)	293.31	63.62	275.51	38.93	1.38	**
Paid material cost (USD/ha)	121.59	46.84	139.79	68.34	-1.33	**
Total material cost (USD/ha)	172.69	39.68	220.65	66.29	-3.77	*
Total hired labor (USD/ha)	51.43	64.74	45.04	47.51	0.47	
Total family labor (USD/ha)	198.35	136.19	116.65	51.19	3.21	*
Total labor cost (USD/ha)	249.78	162.94	161.69	73.92	2.83	*
Total Job commission (USD/ha)	145.30	69.89	178.97	50.87	-2.28	*
Cash land rent (USD/ha)	6.77	21.40	-	-	1.79	*
Owned land rent (USD/ha)	72.25	-	72.25	-	-	
Depreciation cost (USD/ha)	91.35	140.09	33.05	86.17	2.04	*
Total cash expense (USD/ha)	301.03	83.54	332.37	85.98	-1.55	**
Total expense (USD/ha)	738.14	205.68	667.08	116.11	1.74	**
Gross revenue (USD/ha)	1094.05	166.63	977.33	262.12	2.10	*
Total cash income (USD/ha)	754.99	171.69	599.93	280.08	2.56	*
Net profit (USD/ha)	431.07	253.65	431.58	259.21	-0.01	

*p<.05, **p< .01

Rice production of ACs members was significantly more profitable than non-members in terms of gross margin, which not included non-cash costs (Table 6). Although there was no significant difference in yield productivity per hectare between these two groups, the total cash expense of non-members was substantially higher than members. In terms of net profit, it was found that there was no significant difference between the two. In this specific study area, farmers, both members and non-members, rather than raising livestock and obtaining animal manure by themselves, were more favorable to purchase cattle manures or processed natural fertilizers instead. Also, ACs members, particularly organic rice farmers, tended to employ workforce laborers over machines. They were afraid to mix their paddies with others if they use the same machine operation service like combine harvesters, and some machines like planting machines are not available yet. This resulted in higher labor costs.

Overall, in the same farmland unit, with the aids of agricultural cooperatives, members would ensure more significant profit than non-members if they could approach a more integrated farming system.

Challenges of agricultural cooperatives. Despite mentioned benefits that ACs have provided to their members, the number of challenges has restrained their performances and hindered their ability to meet members' needs. Some of those significant challenges are explained in detail below (Table 7).

- a. Shortage of capital and credit facilities.** Although members reported being pretty satisfied with the access to credit; however, more than 80 percent of them wished to access to bigger loan than what ACs endows currently (Table 7). ACs leaders claimed that the key reason for establishing the cooperatives was to mobilize the savings to invest in their cooperatives' operations. Still, the capital savings of the cooperatives did not satisfy the needs of their members. In most cases, farmers could only borrow up to 250USD from ACs, and only a few farmers could borrow more than that. As some members of ACs were still in the categories of small-sized farmers with no official land title, most of them could not afford to take loans from microfinance institutes with high-interest rates. This indicated poor farmers in the group might not be able to practice sustainable farming, even though they have learned farming techniques from their cooperatives and do have the means to put them into practice. Moreover, some techniques were over farmers' budgets (biogas), and animal manure and labors in the study area were quite hard to obtain and pricey.
- b. Impractical farming techniques and marketing power.** Some literature has stated that sustainable agricultural techniques are not always applicable in members' areas, implying that technical services do not always respond to ACs members' needs. More than half of interviewed ACs members stated that they did not get the results as demonstrated in training despite following the professional guidelines. This was due to the immense complexity in applying the instructions and the lengthy time for the taught techniques' outcome.

Lack of collective marketing also stopped farmers from accessing more markets and getting better output prices. Although organic rice is a high-value-added crop, only a few members and one agricultural cooperative in the study area adopted them. Other sustainable rice is not niche markets as organic rice and shares the same price with other conventional rice farming systems. This might discourage farmers in the study area from adopting other sustainable farming systems besides organic farming.

- c. Illiteracy and limited knowledge of AC committee and farm members.** Low capacity of human resources, including limited leadership and poor bookkeeping, financial management, and communication skills, is also identified as a critical factor for ACs in the study area as well. This made it challenging to find educated or even literate candidates to be elected or selected as leaders or management members. In some ACs, committee members were unable to read or write, lacked public speaking experience, and had inadequate planning capacity, but were nonetheless elected because of the absence of alternate candidates; this could impede the overall performance development of ACs. Given the members' limited awareness, they found it difficult to understand the cooperatives' role and function, let alone the legal structure for ACs. This is a critical problem that quickly leads to distrust, especially among members and between members and the AC management committees over financial records. Although leaders and committee members had rich experiences in farming, they lacked in agribusiness knowledge and organization management. ACs are only as strong as the level of skills of their members. For instance, manager-members require bookkeeping, leadership, communication, techniques, and agribusiness management. At the same time, members need to learn about relevant and necessary farming techniques such as sustainable farming techniques and group work.

d. Limited participation from members and weak enforcement of internal regulations. The study noted that low participation from members is a general issue faced by ACs, as depicted by more than 50 percent claiming this problem (Table 7). Farmers appeared not to attend the monthly sessions, repay money late, and lose confidence in attending community events, the chief and committee members of the ACs said. For this, there were several explanations. First, members who deeply in debt to the ACs tended to avoid taking part in ACs' activities. Second, some members were so busy working off-farm jobs that they did not have enough time to participate. Third, the AC leaders needed to strike a balance between rule enforcement and tolerance when some members did not conform to the ACs' rules. The management was too intimate for members to apply the rules for unity or for fear of displeasing or losing members. This is typical in small groups, where a sense of personal connection is established by the leader and members (Chanrith 2008).

Table 7. Challenges affecting the performance of ACs

Challenges	Responses from AC members		
	Yes	No	Don't know
Shortage of capital and credit facilities	81%	19%	0
Lack or unavailable of marketing service	79%	11%	0
Impractical provided knowledge and techniques	78%	22%	0
Lack of external supports	70%	30%	0
Members' illiteracy	55%	44%	0
Do not respond to members' needs	53%	41%	6%
Lack of members' participation	52%	48%	0
Lack of leadership and work capability	49%	50%	1%
Poor bookkeeping/financial management	47%	43%	0
Poor enforcement of internal regulation	47%	39%	4%
Poor communication with local authority	28%	58%	14%

CONCLUSION

Sustainable farming was found to be an effective contribution by agricultural cooperatives in the research area. Although there were no significant differences in paddy yields and net profit between ACs members and non-members, there was a significant difference in gross margin between ACs members and non-members.

ACs have also benefited members through training in sustainable farming techniques with less use of agrochemicals, providing them with natural materials, assistance with loans at low-interest rates, entry to the natural goods market, and developing relationships and alliances with key stakeholders such as agricultural inputs suppliers (for instance seed producers and organic fertilizers companies), agricultural retailers, and local authority to produce greater products at lower prices.

Many constraints hindered the development of agricultural cooperatives in the studied area. Agricultural cooperatives' limited ability to extend credit and market services has hindered many ACs members from adopting sustainability and ensuring their productivity. Other vital challenges for ACs in the study areas are limited planning skills, marketing power, lack of educated management members, lack of external support, and weak enforcement of internal rules and regulations.

At the very least, this study offered crucial insights and essential evidence on the effects of participation in agricultural cooperatives on the implementation of sustainable farming and the significant challenges faced by agricultural cooperatives. Strengthening agricultural cooperatives to boost rural well-being effectively and foster sustainable agriculture for potential future agricultural development is a feasible and rational imperative for all primary stakeholders.

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